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The Genus *Aulacaspis* Cockerell, 1893 (Sternorrhyncha, Diaspididae) in Korea

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한국산 흰깍지벌레속(진딧물아목, 깍지벌레과)의 분류학적 연구

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ABSTRACT : Five species of the genus *Aulacaspis* (Sternorrhyncha, Diaspididae) from Korea were redescribed and illustrated for the morphological characters of adult females with the information of known host plants. Among them, *Aulacaspis spinosa* (Maskell, 1897) is reported for the first time from the Korean Peninsula. A key to species is given for the adult females.

KEY WORDS : Sternorrhyncha, Diaspididae, *Aulacaspis*, Host plant

초 록 : 한국산 흰깍지벌레속(진딧물아목, 깍지벌레과)의 5종에 대해 암컷 성충의 외부 형태를 바탕으로 형태적 특징을 기술하고 도해하였고, 검색표도 작성하였으며, 각 종에 대한 기주식물을 나열하였다. 이중 청미레덩굴흰깍지벌레(신칭)는 한국에서 처음으로 기록되는 종이다.

검색어 : 진딧물아목, 깍지벌레과, 흰깍지벌레속, 기주식물

Aulacaspis Cockerell, 1893 is widely distributed in all zoogeographical regions, including Oriental and Palaearctic regions. In this genus 89 species have been recorded in the world and 30 species in Palaearctic region with *Aulacaspis rosae* (Bouché, 1834) as type species (Miller *et al.*, 2002). The genus *Aulacaspis* is pests on bark, stem and leave of woody and herbaceous plants, including rose (Kosztarab, 1996). Adult female of *Aulacaspis* can be easily distinguished from their allies by the following characters: body elongated, head swollen round or quadrate, lobes with 3 or 4 pairs, median lobes forming a distinct notch, no setae between median lobes, and other lobes bilobed.

In Korea, *A. rosae* Bouché, 1833 was listed for the first time by Nakayama (1933), *A. distylii* Takahashi, 1955 by Paik and Kwon (1977), and *A. yabunikkei* Kuwana, 1926 by Paik (1978). Han *et al.* (2002) recorded *A. rosarum* Borchsenius, 1958 on *Rosa hybrida* Hort. and *Rubus crataegifolius* Bunge.

For correct identification of the genus *Aulacaspis* from Korea, this study was carried out at the base of 196 specimens collected during 1998 to 2001 and eight specimens collected during 1976 to 1977. In this study, five species of *Aulacaspis* were recognized from the Korean Peninsula, including a new records, *A. spinosa* (Maskell, 1897). These all species were redescribed and illustrated the dorsal surface on the left and ventral surface on the right with the information of host plants, and a key is

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given for the Korean five species. All the specimens of this study are deposited in the Insect Collection of National Institute of Agricultural Science and Technology (NIAST). Abbreviations are given as follows; GG: Prov. Gyeonggi-do, GW: Prov. Gangwon-do, CB: Prov. Chungcheongbuk-do, JB: Prov. Jeollabuk-do, JN: Prov. Jeollanam-do, GN: Prov. Gyeongsangnam-do, JJ: Prov. Jeju-do.

Systematic Accounts

Genus *Aulacaspis* Cockerell, 1893 흰깍지벌레속

Aulacaspis Cockerell, 1893, Inst. Jamaica J. 1: 180 (Type species: *Aspidiotus rosae* Bouché, 1834).

Miscanthaspis Takagi, 1961, Insecta Matsumurana 24: 69 (Type species: *Aulacaspis kuzunoi* Kuwana et Muramatsu, 1932).

Superturmaspis Chen, 1983, Chionaspidini China: 85 (Type species: *Chionaspis schizosoma* Takagi, 1970).

Semichionaspis Tang, 1986, Scale Insects Horticulture & Forest China 3: 170 (Type species: *Chionaspis schizosoma* Takagi, 1970).

Aulacaspis distylii Takahashi, 1955 조록나무흰깍지벌레(Fig. 1)

Aulacaspis distylii Takahashi, 1955, Biogeog. Soc. Japan Bull. 16(19): 240 (Type locality: Nakijin, Okinawa Island, Japan: on *Distylium* sp.); Takagi, 1961: 79; Paik & Kwon, 1977: 15 (first record in Korea); Paik, 1978: 304; Kawai, 1980: 297; Paik, 2000: 130.

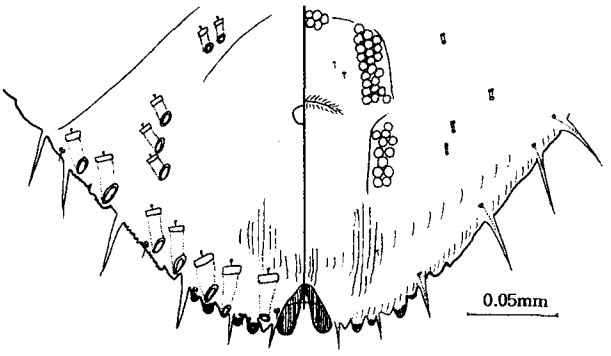

Fig. 1. Adult female pygidium of *Aulacaspis distylii* Takahashi, 1955.

Diagnosis. Female scale broad oval or circular, covered with white and pale brown exuviae on margin.

Morphology: Body elongated, 0.66 mm long and 0.46 mm wide. Head rounded. Anterior spiracles with 4 pores. Posterior spiracles with a pore. *Pygidium*. With 2 ducts on submedia of each 3rd-5th abdominal segment; 2-4 ducts on submargins of each 2nd-5th abdominal segment; median lobe well developed, forming a median notch, with fine serration on inner margin; 2nd and 3rd lobe bilobed; 4th lobe with 3 serrate.

Material examined. [JJ] 2♀, Andeok-gyegok: Gamsan-ri: Andeok: Namjeju, 6. VIII. 1977 (W.H. Paik), on *Distylium racemosum* S. et Z. (Hamamelidaceae).

Distribution. Palaearctic (Korea (South), Japan (Honshu, Kyushu, Shikoku)) and Oriental regions (Ryukyu Islands).

Host plants. Korea: *D. racemosum*. World: *D. racemosum, Distylium* sp.

Aulacaspis rosae (Bouché, 1833) 장미흰깍지벌레(Fig. 2)

Aspidiotus rosae Bouché, 1833, Naturgeschichte Schädlichen Nützlichen Garteninsekten: 53 (Type locality: Berlin, Germany).

Aulacaspis rosae: Ferris, 1937, Atlas Scale Ins. North America: 10; Nakayama, 1933: 226 (first record in Korea); Takagi, 1961: 79; Ju, 1969: 54; Paik, 1978:

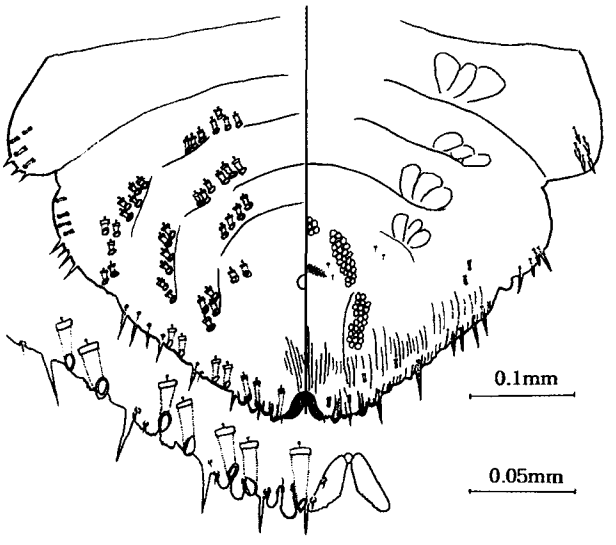

Fig. 2. Adult female pygidium of *Aulacaspis rasae* (Bouché, 1833).

305; Danzig, 1980: 323; Kawai, 1980: 299; Kosztarab & Kozár, 1988: 327; Paik, 2000: 131.

Diagnosis. Female scale broad oval or circular, covered with white to yellowish white and brown exuviae on submargin or margin.

Morphology: Body elongated, 1.14-1.32 mm long and 0.65-0.89 mm wide. Head rounded. Anterior spiracles with 19-35 pores. Posterior spiracles with 7-12 pores. *Pygidium*. With 3-4 ducts forming 2 rows on submedium of 3rd abdominal segment and 4-7 ducts forming 2 rows on submargin; 2-4 ducts forming 2 rows on submedium of 4th abdominal segment and 6-10 ducts forming a row on submargin; 4-5 ducts forming a row on submedium of 5th abdominal segment and 4-5 ducts forming a row on submargin; 2-3 ducts on submedium of 6th abdominal segment; median lobe well developed, forming a median notch, with fine serration on inner margin; 2nd and 3rd lobe bilobed, 4th lobe with 2 serrate.

Material examined. [GG] 7♀, Seodun-dong: Suwon, 28. IX. 2001 (G.M. Kwon), on *Rubus parvifolius* L. (Rosaceae); 4♀, same data, except for 28. II. 2000, on *Rubus crataegifolius* Bunge (Rosaceae). [CB] 4♀, Daegang-myeon: Danyang, 18. V. 2001 (G.M. Kwon), on *R. crataegifolius*. [JN] 9♀, Daeyul-ri: Samae: Namwon, 19. IX. 2001 (G.M. Kwon), *R. crataegifolius*. [GN] 12♀, Chojeon-dong: Jinju, 24. IV. 2001 (G.M. Kwon), on *Rosa* sp.; 3♀, Sanam-myeon: Sacheon, 16. III. 2000 (G.M. Kwon), on *R. crataegifolius*. [JJ] 7♀, Daeseo-ri: Chuja: Bukjeju, 12. VI. 2001 (G.M. Kwon), on *Rosa wichuraiana* Crep; 5♀, Sagae-ri: Andeok: Bukjeju, 14. VI. 2001 (G.M. Kwon), on *Rosa multiflora* Thunberg (Rosaceae); 2♀, Seogwipo, 6. VII. 1977 (W.H. Paik), on *Rubus hirsutus* Thunb.

Distribution. Cosmopolitan.

Host plants. Korea: Rosaceae (*Rosa multiflora, Ro. wichuraiana, Rubus crataegifolius, Ru. hirsutus, Ru. parvifolius*). World: Thirty-two species in 5 families (Miller *et al.*, 2002).

Aulacaspis rosarum Borchsenius, 1958 각진장미흰깍지벌레(Fig. 3)

Aulacaspis rosarum Borchsenius, 1958, Entomol. Obozr. 37: 165 (Type locality: Chengtu, China: on *Rosa* sp.); Chen, 1983: 52; Williams & Watson, 1988: 72; Han *et al.*, 2002: 50 (first record in Korea).

Diagnosis. Female scale broad oval or circular, covered with white to gray and brown exuviae on submedium or submargin.

Morphology: Body elongated, 1.15-1.60 mm long and 0.66-0.90 mm wide. Head angled on margin. Anterior spiracles with 21-37 pores. Posterior spiracles with 7-15 pores. *Pygidium*. With 4-6 ducts forming 2 rows on submedium of 2nd abdominal segment; 4-6 ducts forming 2 rows on submedium of 3rd abdominal segment and 7-9 ducts forming a row on submargin; 3-4 ducts forming 2 rows on submedium of 4th abdominal segment and 3-6 ducts forming a row on submargin; 4-6 ducts forming a row on submedium of 5th abdominal segment and 3-6 ducts forming a row on submargin; 2-6 ducts on 6th abdominal segment; median lobe well developed, forming a median notch, with fine serration on inner margin; 2nd and 3rd lobe bilobed; 4th lobe with 1 serrate.

Material examined. [Seoul] 27♀, Sadang-dong: Dongjak, 3. VII. 1998 (G.M. Kwon), on *Rosa hybrida* Hort. (Rosaceae). [GG] 7♀, Gimpo, 20. V. 1998 (G.M. Kwon), on *R. hybrida*; 14♀, Oryu-dong: Gyeyang: Incheon, 6. III. 2001 (Y.J. Im), same host plant; 46♀,

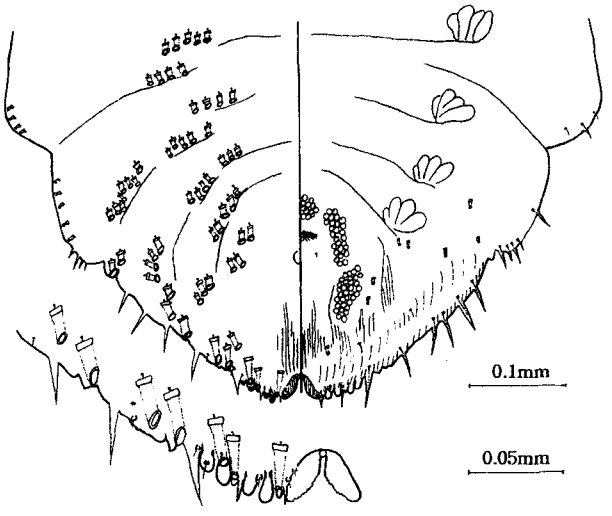

Fig. 3. Adult female pygidium of *Aulacaspis rosarum* Borchsenius, 1958.

Guwon-dong: Suwon, 31. III. 1998 (S.B. Ahn), same host plant; 11♀, Seodun-dong: Suwon, 8. IV. 1998 (G.M. Kwon), same host plant; 3♀, same data, except for 28. II. 2000, on *Rubus crataegifolius* Bunge (Rosaceae). [GW] 22♀, Dangu-dong: Wonju, 4. IV. 1998, on *R. hybrida*. [CB] 3♀, Cheongju, 1. VIII. 1996 (S.B. Ahn), *R. hybrida*; 9♀, Same data, except for 13. X. 2001 (G.H. Choi). [GN] 1♀, Yangsan, VI. 1999 (Y.H. Lee), on *R. hybrida*; 2♀, Geoje, 18. V. 1977 (W.H. Paik), on *R. hybrida*; 3♀, Busan, 15. X. 1976 (W.H. Paik), same host plant.

Distribution. Palaearctic (Korea (South), China, Mongolia), Oriental and Australasian regions.

Host plants. Korea: Rosaceae (*Rosa hybrida, Rubus crataegifolius*). World: Euphkoirbiaceae (*Sapium sebiferum*); Lauraceae (*Cinnamomum camphora*); Moraceae (*Ficus* sp.); Rosaceae (*Rosa indica*, *Rosa* sp., *Rubus occidentalis*, *Rubus* sp.).

Remarks. This species is similar to *A. rosae*, but it can be separated by the angled margin of head and the present of ducts forming 2 rows on submedium of 2nd abdominal segment.

Aulacaspis spinosa (Maskell, 1897) 청미레덩굴흰깍지벌레(신칭) (Fig. 4)

Diaspis rosae spinosa Maskell, 1897, Ent. Mon. Mag. 33: 241 (Type locality: Japan: on *Smilax* sp.).

Aulacaspis spinosa: Kuwana, 1926, Japan Dept. Finance, Imp. Plant Quar. Serv. Tech 4: 24; Kawai, 1980: 296; Takagi, 1961: 79.

Aulacaspis pseudospinosa Chen, Wu et Su, 1980, Acta Zootaxonomica Sinica 5: 293 (Type locality: Qingeheng, Sichuan Province, China: on *Smilax* sp.).

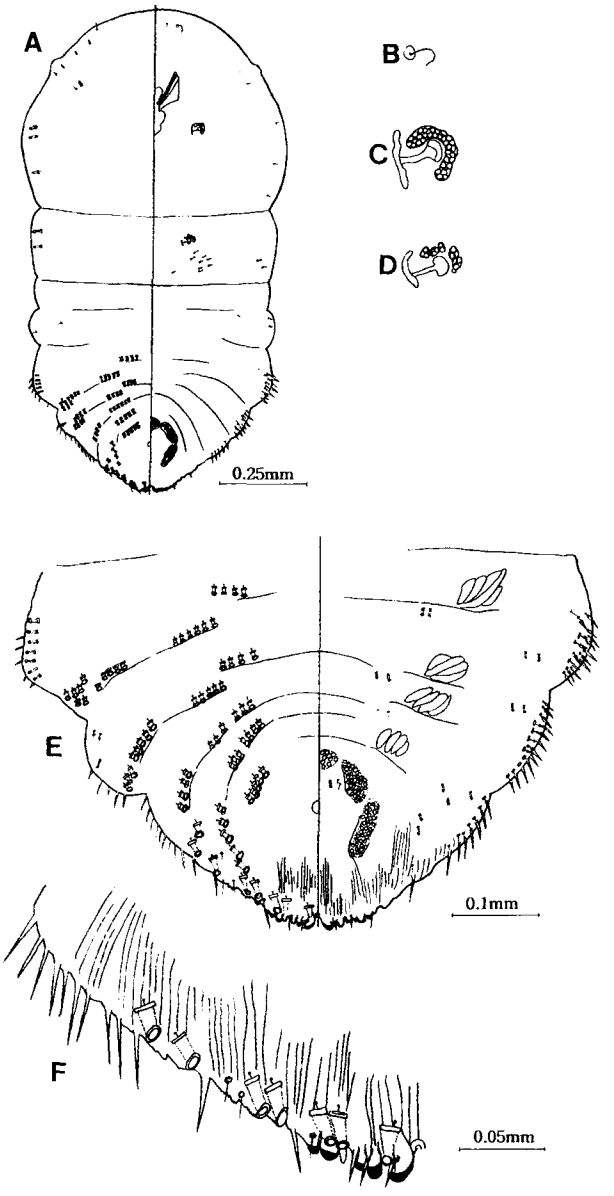

Fig. 4. Adult female of *Aulacaspis spinosa* (Maskell, 1897). A, Body; B, Antenna; C, Anterior spiracle; D, Posterior spiracle; E, Pygidium.

Diagnosis. Female scale broad oval, covered with white and brown exuviae on submargin or margin.

Morphology: Body elongated, 1.15-1.45 mm long and 0.77-1.05 mm wide (Fig. 4A). Head rounded. Prothorax rounded with short several satae and microducts. Antennae with a long seta (Fig. 4B). Anterior spiracles with 38-45 pores (Fig. 4C). Posterior spiracles with 12-22 pores (Fig. 4D). *Pygidium* (Fig. 4E). Spines and microducts numerous on margin of 2nd and 3rd abdominal segment; 2-7 ducts forming 2 rows on submedium of 2nd abdominal segment and 3-6 ducts forming 2 rows on submargin; 3-6 ducts forming 2 rows on submedium of 3rd abdominal segment and 6-10 ducts forming a row on submar-gin; 3-4 ducts forming 2 rows on submedium of 4nd abdominal segment and 2-5 ducts forming 2 rows on submargin; 2-5 ducts forming 2 rows on submedium of 5th abdominal segment and 4-5 ducts forming a row on submargin; 3-6 ducts forming a row on

6th abdominal submedium; median lobe well developed, forming a median notch, without serration on inner margin; 2nd and 3rd lobe bilobed, 3rd lobe wider than 2nd lobe; 4th lobe with 3 serrate.

Material examined. [JB] 8♀, Gaok-ri: Muju: Muju, 20. IX. 2001 (G.M. Kwon), on *Smilax sieboldii* Miq. (Liliaceae); 4♀, Daewol-ri: Samae: Namwon, 19. IX. 2001 (G.M. Kwon), on *Smilax china* L. (Liliaceae). [JN] 4♀, Yulchi-ri: Pungyang: Goheung, 13. I. 2000 (G.M. Kwon), on *S. china*. [JJ] 8♀, Odong-dong: Jeju, 6. XII. 2000 (G.M. Kwon), on *Photinia glabra* (Thunb.) Max (Rosaceae); 5♀, Eoseungsaeng: Halla-san: Bukjeju, 17. IV. 2000 (G.M. Kwon), on *S. china*.

Distribution. Palaearctic (Korea (South, new record), Japan, China) and Oriental regions.

Host plants. Korea: Liliaceae (*S. china, S. sieboldi*); Rosaceae (*P. glabra*). World: Arecaceae (*Trachycarpus excelsa*); Lauraceae (*Phoebe nanmu*); Liliaceae (*S. china*); Orchidaceae (*Cymbidium* sp.).

Remarks. This species is similar to *A. rosarum*, but it can be separated by the present of numerous spines and microducts on margin of 2nd abdominal segment and the present of ducts forming 2 rows on submedium of 2nd abdominal segment.

Aulacaspis yabunikkei Kuwana, 1926
참식나무흰깍지벌레(Fig. 5)

Aulacaspis yabunikkei Kuwana, 1926, Japan Dept. Finance, Imp. Plant Quar. Serv. 4: 32 (Type locality: Japan, on *Cinnamomum pedunculatum*); Takagi, 1961: 77; Takagi, 1970: 87; Paik, 1978: 307 (first record in Korea); Kawai, 1980: 299; Paik, 2000: 131.

Diagnosis. Female scale circular, covered with opaque white and pale yellow exuviae on margin.

Morphology: Body elongated, 1.10-1.37 mm long and 0.68-0.82 mm wide. Head and prothorax swollen rounded. Anterior spiracles with 5-11 pores. Posterior spiracles with 2-7 pores. *Pygidium*. With 3-4 ducts forming a row on submedium of 3rd abdominal segment and 3-5 ducts forming a row on submargin; 2-4 ducts on submedium of 4th abdominal segment and 1-3 ducts on submargin; 1-2 ducts on submedium of 5th abdominal segment and 1-3 ducts on submargin; 0-2 ducts on 6th abdominal segment; median lobe well developed, forming a median notch, with fine serration on inner and outer margins; 2nd and 3rd lobe bilobed; 4th lobe with 2 serrate.

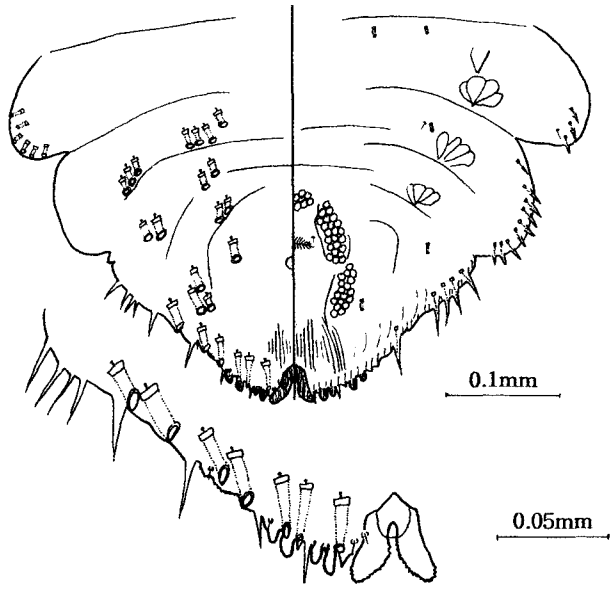

Fig. 5. Adult female pygidium of *Aulacaspis yabunikkei* Kuwana, 1926.

Material examined. [JN] 2♀, Daegu-myeon: Gangjin, 3. VII. 1977 (W.H. Paik), on *Neolitsea aciculata* (Bl.) Koidz. (Lauraceae); 6♀, Daeheung-sa: Gurim-ri: Samsan: Haenam, 20. XII. 1976 (W.H. Paik), on *Neolitsea sericea* (Bl.) Koidz (Lauraceae). [JJ] 15♀, Sinheung-ri: Namwon: Namjeju, 17. IV. 1998 (G.M. Kwon), on *N. sericea*; 3♀, Seogwipo, 2. IX. 1977 (W.H. Paik), same host plant.

Distribution. Palaearctic (Korea (South), Japan, China) and Oriental regions.

Host plants. Korea: Lauraceae (*N. aciculata, N. sericea*). World. Eighteen species in 5 families (Miller *et al.*, 2002).

Key to the species of *Aulacaspis* in Korea

1. Spines more than 10 on ventral margins of 2nd and 3rd ab-dominal segments; without serration on inner margin of median lobe. On *Smilax* and *Photinia* .... *A. spinosa*

– Spines less than 10 on ventral margins of 2nd and 3rd

abdominal segments; with serration on inner margin of median lobe 2

2. Pores more than 15 on anterior spiracles 3

– Pores less than 15 on anterior spiracles 4

3. With ducts on 2nd abdominal segment; without serration on outer margin of median lobe. On *Distylium* ..... *A. distylii*

– Without ducts on 2nd abdominal segment; with serration on outer margin of median lobe. On *Neolitsea* ..... *A. yabunikkei*

4. Margin of head rounded, only present 2 microducts; with ducts of 2 rows on submedium of 2nd abdominal segment. On *Rosa* and *Rubus* ..... *A. rosae*

– Margin of head angled; without ducts on submedium of 2nd abdominal segment. On *Rosa* and *Rubus* ..... *A. rosarum*

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